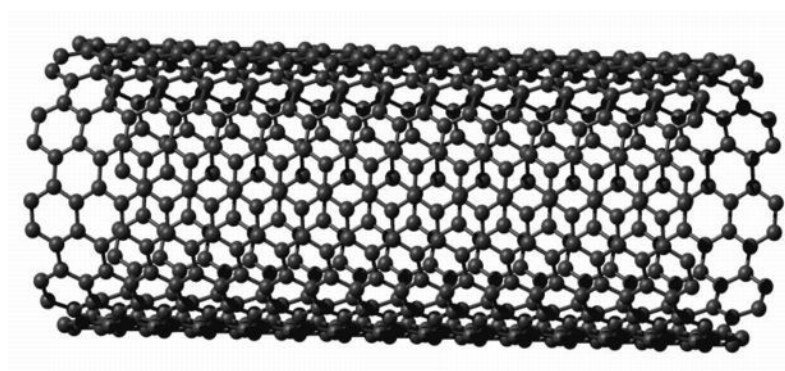


## 10. CABON NANOTUBES

### A. LISTENING<sup>1</sup>.

1. Write down as many facts as you can remember about carbon. Then check in pairs.
2. Watch the beginning of the video *Carbon nanotubes* (0-1.27) and note down which of these facts are mentioned here (+what else):
3. Watch another part of the video (1.27-2.24) and answer these questions:
  - a) What are the researchers in Dresden working on?
  - b) What are the initial components for producing carbon nanotubes?
  - c) What temperatures are needed for the development of nanotubes?
  - d) What does the type and quality of nanotubes depend on?
4. Watch another part of the video (2.24-4.36) and make notes of these:  
components of the cleaning procedure:  
the yield:  
tool used to slice carbon nanotubes:  
instrument used to visualise carbon nanotubes:
5. Watch the end of the video (4.36-5.37) and note down possible uses of carbon nanotubes:



## B. READING<sup>2</sup>

<b>An Article from The New Scientist by Patrick Barry</b>	
A way to cloak carbon nanotubes, making them both non-toxic and highly customisable, has been revealed. It marks a step towards using nanotubes in biological research and medicine.	1
Nanotubes are rolled up sheets of linked carbon atoms and are as little as <sup>[a]</sup> 10 atoms wide. In the future_ they could act as tiny molecular sensors, detecting individual enzymes inside living cells, or could enable new medical treatments for diseases such as cancer.	2
But for reasons that remain unclear, bare nanotubes are toxic, triggering the death of cells that they touch. To deal with this problem, <sup>[b]</sup> researchers at the University of California, Berkeley, US, created rod-shaped synthetic polymers that mimic molecules found naturally on the outer surface of the body's cells. They then attached these molecules to the nanotubes like pine needles on a twig.	3
This polymer coating prevented the nanotubes from damaging cells grown in the lab. They also provide a versatile way to customise the nanotubes. "I think this is a huge step forward that will open the door for using nanotubes for biological uses," says <sup>[c]</sup> Alex Zettl, a physicist on the research team.	4
Nanotubes are extremely stiff and strong molecules and they are excellent conductors of electricity. These extraordinary properties have had scientists scrambling to find uses for them in everything from molecular electronic circuits to ultra-strong, lightweight materials for aircraft.	5
In biology and medicine, scientists imagine using nanotubes to deliver drug molecules into individual cells, or as molecular wires carrying sensors that convert the metabolic activity inside a cell into electric signals.	6

### 1. Vocabulary building: Do you know these verbs?

cloak – pokrýt	roll up - srolovat	deal with – zabývat se	damage – zničit
customize – upravit	remain – zůstat	mimic – napodobovat	scramble – honit se za
reveal – odhalit	trigger – vyoplát	attack – napadat	linger - prodlévat

### 2. Read the text and decide whether the sentences are true or false.

If they are false, say what is true.

- |   |     |
|---|-----|
| a) Bare carbon nanotubes are non-toxic.                     | T/F |
| b) It is necessary to coat nanotubes to make them harmless. | T/F |
| c) Nanotube coating damages living cells.                   | T/F |
| d) Nanotubes conduct electricity poorly.                    | T/F |

**3. Ask about the underlined expressions:**

- a)
- b)
- c)

**4. Answer the questions:**

- a) What kind of synthetic polymers did the researchers create?
- b) What is the shape of these polymers?
- c) Can you mention some properties of nanotubes?
- d) What are the potential future applications of nanotubes in medicine?

**5. Read the rest of the text. Use the word given in capitals to form a word that fits in the space. There is an example in 0.**

But an expert on the (0) **toxicity** of nanotubes says he wonders whether (1) ..... nanotubes for medicinal (2) ..... makes sense, even with such a coating. „Even after (3) ..... they have to be sure they will be (4) ..... eliminated from the body, „ the expert points out. Bare nanotubes do not (5) ..... naturally, and the liver and kidneys can't (6) ..... them. So if this new (7) ..... wore off while the nanotubes were still inside a person's body, they would (8) ..... inside the body's tissues and become toxic. Zettl (9) ..... that the coating they (10) ..... adhered to the nanotubes for several months.

TOXIC  
USE  
APPLY  
MODIFY  
EVENTUAL  
BIODEGRADATION  
REMOVAL  
COAT  
LINGERING  
OPPOSITION  
TEST

**C. SPEAKING.** . The following is a list of possible areas where nanotechnology might be used. Which of them may become true in the future?

Think about their probability and rate them 1-9 (1=the most likely, 9=the least likely).  
Use the words from the probability table below.

Then discuss the probability of such developments in small groups. Form sentences, using modal verbs (can, could, may, must, might, will be able to ... )

*Example: A: I think it is very unlikely that people will be able to use nanotechnology in sunscreens.*

*B: I disagree. I think that it is ...*

**Probability table:**

<b>1</b> virtually certain	more than 99%
<b>2</b> extremely likely	more than 95%
<b>3</b> very likely	more than 90%
<b>4</b> likely	more than 60%
<b>5</b> more likely than not	more than 50%
<b>6</b> unlikely	less than 33%
<b>7</b> very unlikely	less than 10%
<b>8</b> extremely unlikely	less than 5%
<b>9</b> virtually impossible	less than 1 %

Nanorobots flowing in the air, fighting pollution

Nanorobots diagnosing diseases

Nanorobots repairing human body, healing diseases from inside

Creating superstrong fabrics, e.g. to be used in the war as armour (blocking bullets etc.)

Computer industry, electronics – e.g. computer hard drives

Car parts with superb qualities

Cosmetics, e.g. wonderful lipsticks and sunscreens

Perfect sport equipment – e.g. long lasting tennis balls, and hardwearing yet lightweight tennis racquets

Nanofilm-coated "self-cleaning" windows

Manipulating molecules, programmed matter, artificial atoms

Sources: <sup>1</sup> Available at <http://www.youtube.com/watch?v=tgToxaOqF10>

<sup>2</sup> Available at <http://www.newscientist.com/article/dn9169-cloaked-carbon-nanotubes-become-nontoxic.html>

<sup>3</sup> Adapted from Oreská, Alžbeta. *Activity book English for chemists..* Bratislava : STU, 2005..

Lesson adapted from Milada Pavlovová.

## D) HOMEWORK: PREPOSITIONS<sup>3</sup>

consist of- skládat se, sestávat, být složen z

*Her diet consists of nothing but fruit and vegetables.*

divide into - rozdělit

*He divided the bread into two equal parts. ALE He divided the bread in two/half.*

good at a také s 2. a 3. stupněm příd, jména, též slova bad at/better at, the best at/, skillful at etc.

*He is good at English but better at maths.*

interested in - zajímat se o něco /NIKDY NE interested about/

*She is interested in people, music and politics.*

keen on - být blázen do něčeho

*My husband is keen on cars.*

leave for - odejít na nějaké místo ALE leave a place odejít odněkud

*She left for work a moment ago.*

move to - přestěhovat se kam move in /into/ nastěhovat se kam

*She's moving to the country. She moved into the house.*

operate on /nikoli s přímým předmětem/

*They're operating on him tomorrow for cancer.*

prevent sb. from doing sth. - zabránit někomu v něčem

*They prevented me from asking that question.*

### 1) Fill in the gaps with the right prepositions

1. There is no excuse.....lying to your friend.
2. The pupils are excited.....their upcoming trip to the zoo.
3. I wasn't aware.....any problems with the new car.
4. Cubs are protected.....danger by the mother bear.
5. I'm very fond.....my children.
6. We thanked the contributors.....their donations.
7. He doesn't respond.....questions about his personal life.
8. It's sery important to believe.....yourself.
9. Would you be willing to fight.....your ideals?
10. John is grateful.....his parents.....giving him the opportunity for a good education.
11. It took Jane almost half a year to recover.....her automobile accident.
12. The driver of the other car was accused.....reckless driving.
13. I do not agree.....your political views.
14. My father introduced me.....classical music when I was young.
15. If you need me, I'll be here. You can count.....me.
16. Please don't be upset.....me. I didn't mean to hurt your feelings.
17. While we're all hoping.....better weather, we don't expect it.
18. Stop staring.....me!
19. This sentence consists.....five words.
20. Don't blame other people.....your own failures in life.

### 2) Complete the following letter of enquiry with the correct prepositions.

Dear Sir/ Madam,

I am a Spanish student (1) ..... the University (2) ..... Barcelona doing a Master's Course (3) ..... Business Studies, and I intend to spend six months (4) ..... England, (5) ..... January next year, preparing (6)..... the Cambridge First Certificate. Your college was recommended (7) ..... me (8) ..... a fellow student and I would like details (9) ..... the First Certificate course, including fees and dates. Could you also let me know if you can provide accomodation (10)..... me (11)..... Brighton (12)..... an English family. Thank you (13)..... your attention, and I look forward to hearing (14) .... you soon.

Yours faithfully

Maria Ortega